ELECTRONIC SUPPLEMENTARY INFORMATION (ESI)

Hierarchical growth of ZnO nanorods over SnO_2 seed layer: Insights into electronic properties from photocatalytic activity

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1. Preparation of nanostructured SnO_2 thin film used as seed layer

To prepare the seed layer, a polymeric SnO_2 resin was synthesized via polymeric precursor. A tin citrate was chosen as precursor in preparation of the cationic resin precursor to obtain the SnO_2, prepared according to the method proposed by Besso (see M. M. Besso, US Patent 3123120 (10/19/1965)). First, 50 cm^3 of an ammonia solution was introduced dropwise at room temperature in 100cm^3 of an aqueous solution containing citric acid (CA) and dichloride tin. When the pH of the solution reached a value between 2.5 and 3.0, precipitates of tin citrate were filtered and washed, respectively. The white precipitate was dried in air at 60 °C for 24h. The CA was dissolved with minimal water at ambient temperature and then added tin citrate and finally the ethyleneglicol. The molar ratio of CA: metal was 3: 1 and the amount of EG, as determined by mass ratio was 60:40.

The resin viscosity was adjusted by water evaporation until reach 12 cP (centipoise) using a rheometer (Brookfield, LVDV-III ULTRA). Afterwards, the solution was spin-coated onto SiO_2/Si (with Pt electrodes) substrate by using a speed of 10000 rpm for 60 s, followed by water evaporation at 100 ^oC for 30 min. A two-stage heat treatment was performed as follows: initial heating at 300 ^oC for 30 min with a heating rate of 1 $^oC.min^{-1}$ in air atmosphere to pyrolyze the organic compounds followed by an annealing for 2 hours at 500 ^oC with a heating rate of 5 $^oC.min^{-1}$ for crystallization process.

2. Atomic force microscopy analysis

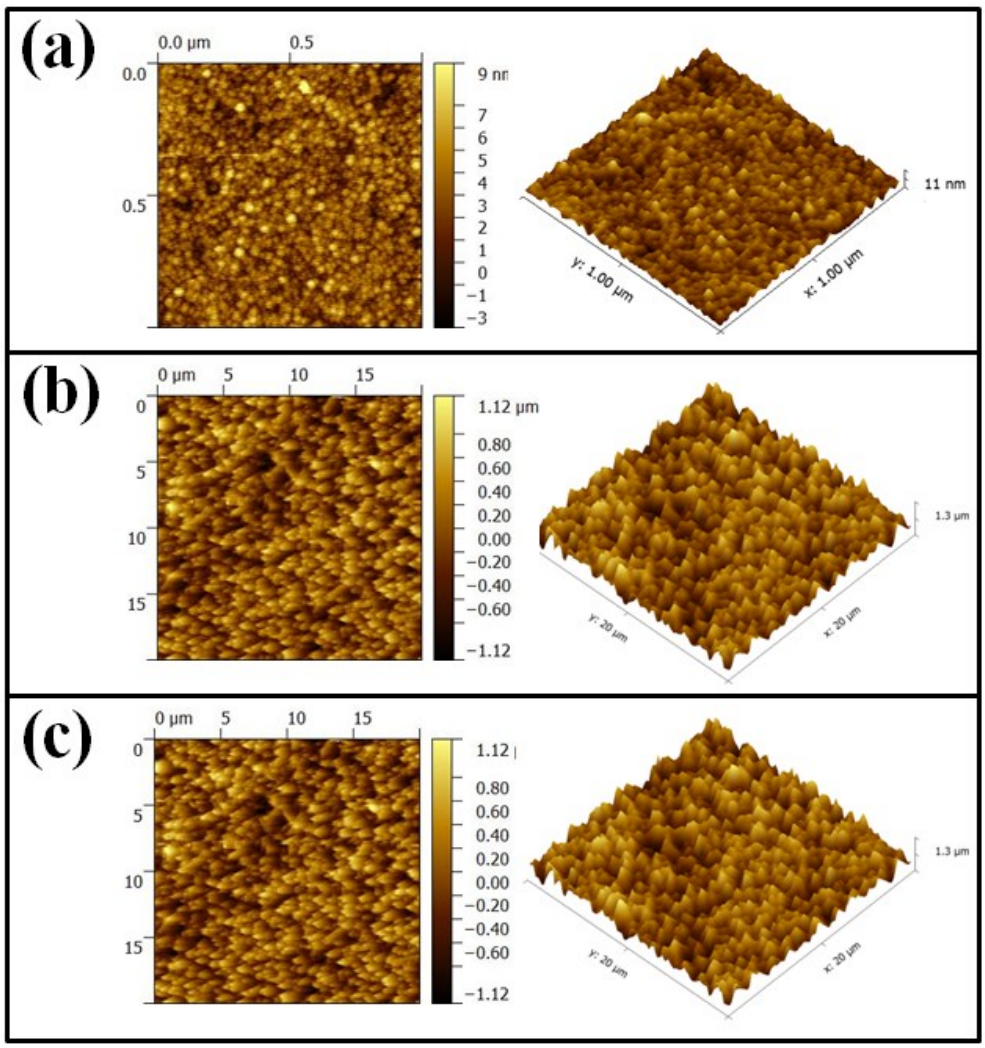

Figure S1. Atomic force microscopy (AFM) images. (a) SnO_2 seed layer, (b) ZnO nanorods grown over a ZnO seed layer, and (c) ZnO nanorods grown over a SnO_2 seed layer exhibited in (a).

3. Field emission scanning electron microscopy analysis

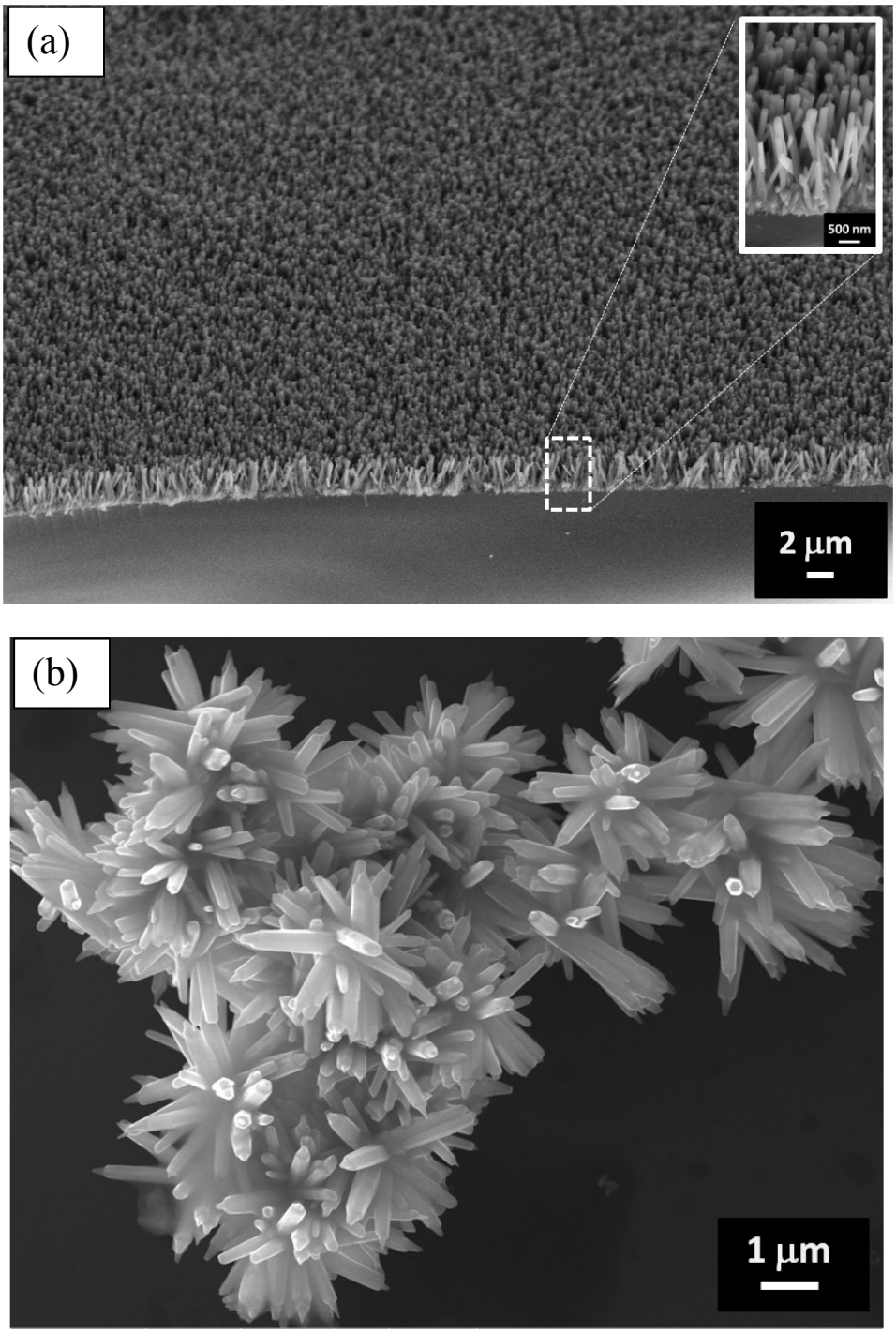

Figure S2. Field emission scanning electron microscopy (FESEM) images of (a) ZnO nanorods grown on a ZnO thin film and (b) as-prepared ZnO powder obtained by the hydrothermal treatment.

4. X-ray photoelectron spectroscopy analysis

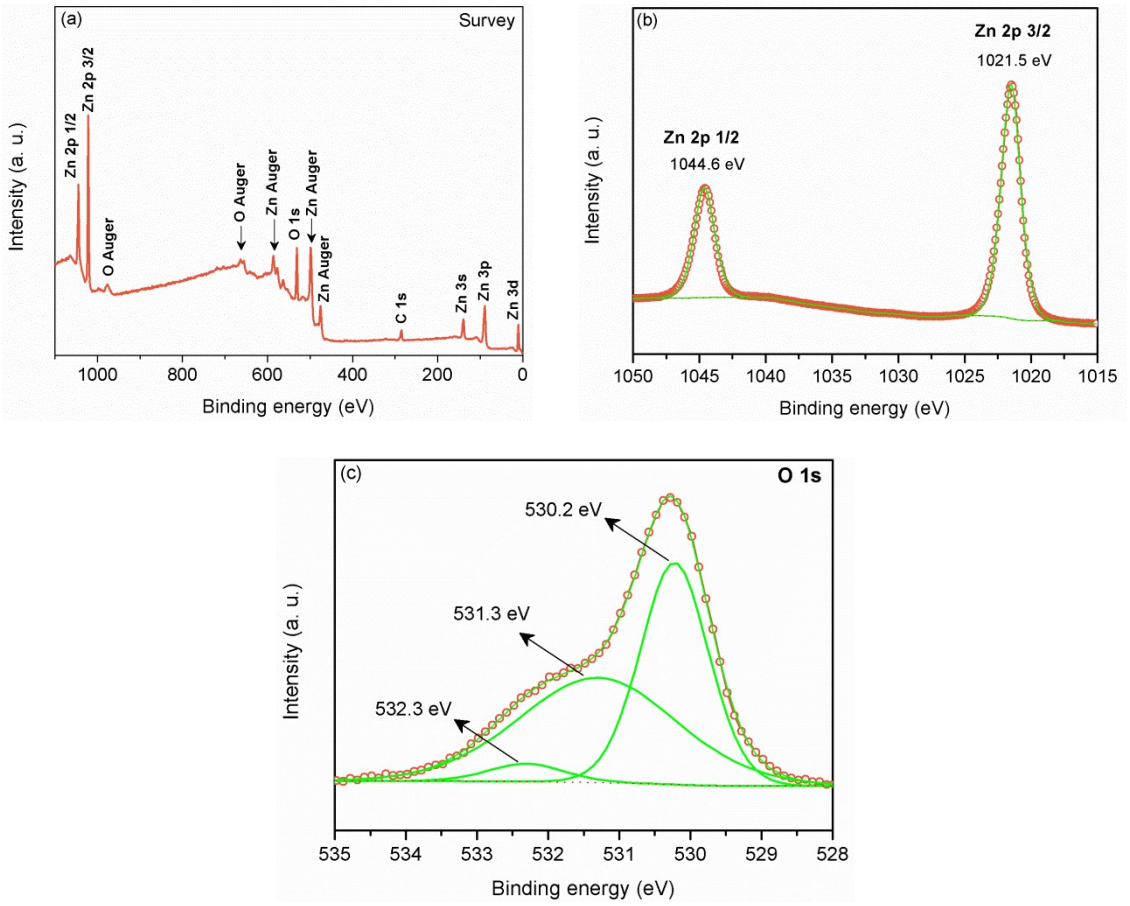

Figure S3. XPS spectra of the ZnO–ZnO sample. (a) Survey XPS scan spectrum, (b) Zn 2p, and (c) O 1s core levels.

Table S1. XPS results obtained from the deconvolution of the O 1s core levels.

Sample	Position (eV)	Area (%)	FWHM	Atomic conc. (%)
ZnO–ZnO	530.2	57409.4	1.1	45.9
	531.3	62560.4	2.6	50.0
	532.3	5105.6	1.3	4.1
ZnO–SnO_2	530.1	55436.8	1.1	35.7
	531.3	83657.5	2.6	53.9
	532.1	16075.6	1.4	10.4

5. Photocatalytic experiments

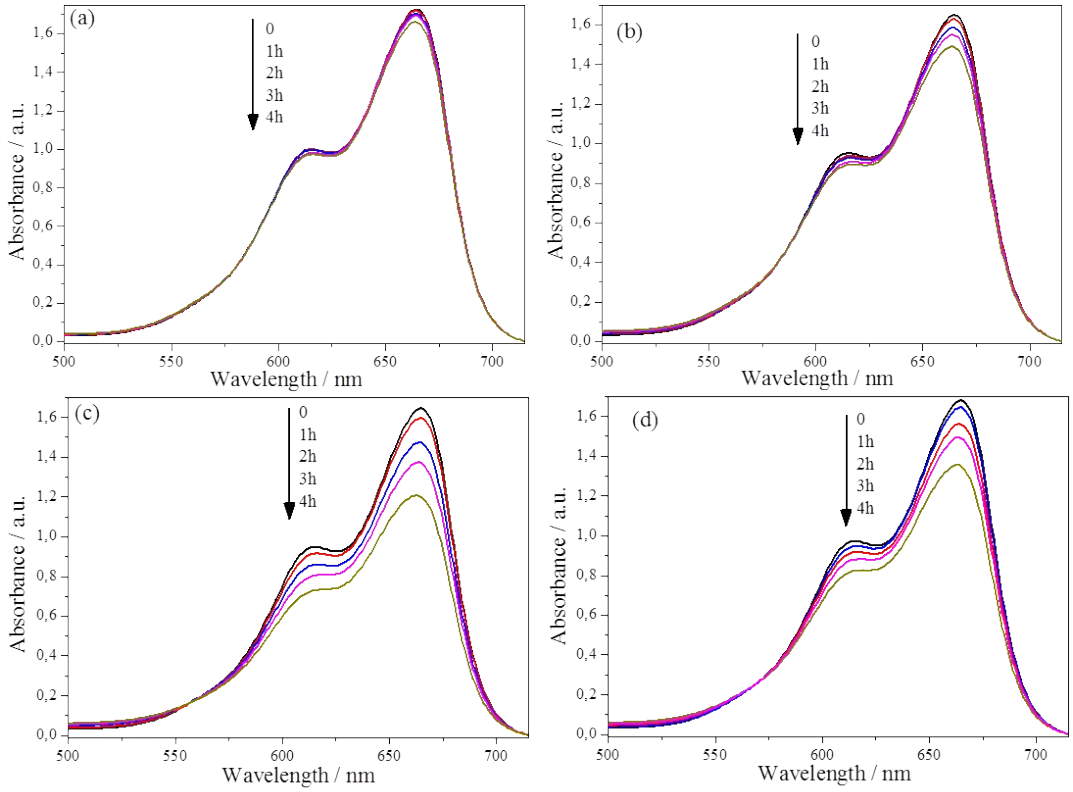

Fig. S4 – UV-vis absorbance spectra of MB in different times of UV irradiation (a) pure and catalyzed by (b) SnO_2 seed layer, (c) ZnO-SnO_2 heterojunction and (d) ZnO-ZnO homojunction.

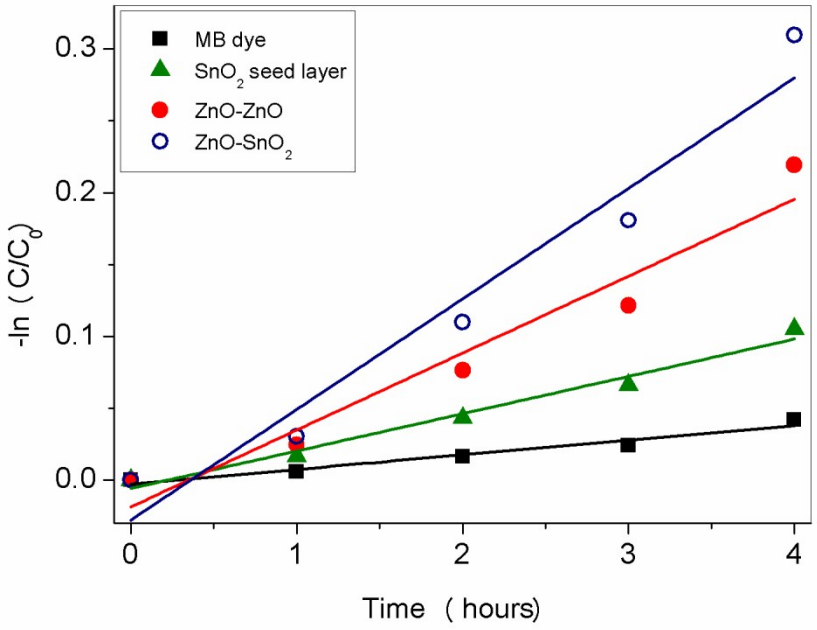

Fig. S5 – Pseudo first-order kinetic for MB photodegradation catalyzed by different samples.